

IOS IPSec および IKE のデバッグ : IKEv1 メインモードのトラブルシューティング

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概要

このドキュメントには、メイン モードと事前共有キー (PSK) を使用する際の Cisco IOS[®] ソフ

トウェアでのデバッグを理解するための情報が記載されています。

また、特定のデバッグ行を設定に変換する方法に関する情報を提供します。

次のトピックについては取り上げません。

- トンネルが確立した後の通過トラフィック
- IPSec またはインターネット キー交換 (IKE) の基本概念

主な問題

IKE および IPSec のデバッグはわかりにくくなりがちです。通常、Cisco Technical Assistance Center (TAC) はこれらのデバッグを使用して、IPSec VPN トンネル確立の問題が発生している場所を特定します。

シナリオ

メイン モードは通常、LAN-to-LAN トンネル間に使用されるか、リモート アクセス (ezvpn) の場合は認証に証明書を使用するときに使用されます。

これらのデバッグは、15.2(1)T ソフトウェア リリースを実行する Cisco IOS デバイスから行われます。

このドキュメントでは、次の 2 つの主なシナリオについて説明します。

- IOS 発信側
- IOS 応答側

このドキュメントでは、2 つのサイト間の VTI ベースのトンネルが IPv6 に基づいて確立されます。

注 :

このドキュメントで使用されているコマンドの詳細を調べるには、[Command Lookup Tool](#) ([登録ユーザ専用](#)) を使用します。

[debug](#) コマンドを使用する前に、『[debug コマンドの重要な情報](#)』を参照してください。

使用したデバッグ

- debug crypto isakmp
- debug crypto ipsec
- debug crypto kmi

IOS ルータの設定

暗号化設定

```
crypto isakmp policy 10
authentication pre-share

crypto isakmp key cisco address ipv6 ::/0

crypto ipsec transform-set TRA esp-aes esp-sha-hmac
mode transport

crypto ipsec profile PRO
set transform-set TRA

interface Tunnel23
ip address 192.168.23.2 255.255.255.0
ipv6 address FE80::23:2 link-local
tunnel source Ethernet0/0
tunnel mode ipsec ipv6
tunnel destination 2001: DB8::3
tunnel protection ipsec profile PRO
```

相手側

```
crypto isakmp policy 10
authentication pre-share

crypto isakmp key cisco address ipv6 ::/0

crypto ipsec transform-set TRA esp-aes esp-sha-hmac
mode transport

crypto ipsec profile PRO
set transform-set TRA

interface Tunnel23
ip address 192.168.23.3 255.255.255.0
ipv6 address FE80::23:3 link-local
tunnel source Ethernet0/0
tunnel mode ipsec ipv6
tunnel destination 2001: DB8::2
tunnel protection ipsec profile PRO
```

デバッグ

IOS 応答側

メイン モード メッセージ 1 (MM1)

IKE の初期提案には次が含まれます。

- 暗号化
- ハッシュ
- Diffie-Hellman (DH) グループ
- ライフタイム

```
*Sep 21 08:33:43.377: ISAKMP (0) : received packet from 2001: DB8::2 dport 500
sport 500 Global (N) NEW SA
*Sep 21 08:33:43.377: ISAKMP: Created a peer struct for 2001: DB8::2, peer port
500
*Sep 21 08:33:43.377: ISAKMP: New peer created peer = 0x8E45588
peer_handle = 0x8000000A
*Sep 21 08:33:43.377: ISAKMP: Locking peer struct 0x8E45588, refcount 1 for
crypto_isakmp_process_block
*Sep 21 08:33:43.377: ISAKMP: local port 500, remote port 500
*Sep 21 08:33:43.377: ISAKMP: (0):insert sa successfully sa = 6D12A00
*Sep 21 08:33:43.377: ISAKMP: (0):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.377: ISAKMP: (0): Old State = IKE_READY New State = IKE_R_MM1
*Sep 21 08:33:43.377: ISAKMP: (0): processing SA payload. message ID = 0
*Sep 21 08:33:43.377: ISAKMP: (0):found peer pre-shared key matching 2001:
DB8::2
*Sep 21 08:33:43.377: ISAKMP: (0): local preshared key found
*Sep 21 08:33:43.377: ISAKMP: Scanning profiles for xauth ...
*Sep 21 08:33:43.377: ISAKMP: (0):Checking ISAKMP transform 1 against priority
10 policy
*Sep 21 08:33:43.377: ISAKMP:          encryption DES-CBC
*Sep 21 08:33:43.377: ISAKMP:          hash SHA
*Sep 21 08:33:43.377: ISAKMP:          default group 1
*Sep 21 08:33:43.377: ISAKMP:          auth pre-share
*Sep 21 08:33:43.377: ISAKMP:          life type in seconds
*Sep 21 08:33:43.377: ISAKMP:          life duration (VPI) of 0x0 0x1 0x51 0x80
*Sep 21 08:33:43.377: ISAKMP: (0):atts are acceptable. Next payload is 0
*Sep 21 08:33:43.377: ISAKMP: (0):Acceptable atts:actual life: 0
*Sep 21 08:33:43.377: ISAKMP: (0):Acceptable atts:life: 0
*Sep 21 08:33:43.377: ISAKMP: (0):Fill atts in sa vpi_length:4
*Sep 21 08:33:43.377: ISAKMP: (0):Fill atts in sa life_in_seconds:86400
*Sep 21 08:33:43.377: ISAKMP: (0):Returning Actual lifetime: 86400
*Sep 21 08:33:43.377: ISAKMP: (0):: Started lifetime timer: 86400.

*Sep 21 08:33:43.377: ISAKMP: (0):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.377: ISAKMP: (0): Old State = IKE_R_MM1 New State = IKE_R_MM1
```

関連する設定 :

```
crypto isakmp policy 10
authentication pre-share
```

メイン モード メッセージ 2 (MM2) : 応答の送信

```
*Sep 21 08:33:43.377: ISAKMP: (0): sending packet to 2001: DB8::2 my_port 500
peer_port 500 (R) MM_SA_SETUP
*Sep 21 08:33:43.377: ISAKMP: (0): Sending an IKE IPv6 Packet.
*Sep 21 08:33:43.377: ISAKMP: (0):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.377: ISAKMP: (0): Old State = IKE_R_MM1 New State = IKE_R_MM2
```

メイン モード メッセージ 3 (MM3)

次が含まれます。

- ネットワーク アドレス変換 (NAT) 検出
- DH 交換部分 1

```
*Sep 21 08:33:43.381: ISAKMP (0): received packet from 2001:DB8::2 dport 500
sport 500 Global (R) MM_SA_SETUP
*Sep 21 08:33:43.381: ISAKMP: (0):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
```

```
*Sep 21 08:33:43.381: ISAKMP: (0): Old State = IKE_R_MM2 New State = IKE_R_MM3
*Sep 21 08:33:43.381: ISAKMP: (0): processing KE payload. message ID = 0
*Sep 21 08:33:43.393: ISAKMP: (0): processing NONCE payload. message ID = 0
*Sep 21 08:33:43.393: ISAKMP: (0):found peer pre-shared key matching 2001:
DB8::2
*Sep 21 08:33:43.393: ISAKMP: (1011): processing vendor id payload
*Sep 21 08:33:43.393: ISAKMP: (1011): vendor ID is DPD
*Sep 21 08:33:43.393: ISAKMP: (1011): processing vendor id payload
*Sep 21 08:33:43.393: ISAKMP: (1011): speaking to another IOS box!
*Sep 21 08:33:43.393: ISAKMP: (1011): processing vendor id payload
*Sep 21 08:33:43.393: ISAKMP: (1011): vendor ID seems Unity/DPD but major 0
mismatch
*Sep 21 08:33:43.393: ISAKMP: (1011): vendor ID is XAUTH
*Sep 21 08:33:43.393: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.393: ISAKMP: (1011): Old State = IKE_R_MM3 New State =
IKE_R_MM3
```

メイン モード メッセージ 4 (MM4)

次が含まれます。

- NAT 検出ペイロード
- DH 交換の続き

```
*Sep 21 08:33:43.405: ISAKMP: (1011): sending packet to 2001: DB8::2 my_port
500 peer_port 500 (R) MM_KEY_EXCH
*Sep 21 08:33:43.405: ISAKMP: (1011): Sending an IKE IPv6 Packet.
*Sep 21 08:33:43.405: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.405: ISAKMP: (1011): Old State = IKE_R_MM3 New State =
IKE_R_MM4
```

メイン モード メッセージ 5 (MM5) : 発信側が ID を送信します。

次が含まれます。

- ローカル ID 情報
- キー

```
*Sep 21 08:33:43.425: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) MM_KEY_EXCH
*Sep 21 08:33:43.425: ISAKMP: (1011):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.425: ISAKMP: (1011): Old State = IKE_R_MM4 New State =
IKE_R_MM5

*Sep 21 08:33:43.425: ISAKMP: (1011): processing ID payload. message ID = 0
*Sep 21 08:33:43.425: ISAKMP (1011): ID payload
    next-payload : 8
    type          : 5
    address       : 2001: DB8::2
    protocol      : 17
    port          : 500
    length        : 24
*Sep 21 08:33:43.425: ISAKMP: (0):: peer matches *none* of the profiles
*Sep 21 08:33:43.425: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.425: ISAKMP: (1011): processing NOTIFY INITIAL_CONTACT
protocol 1 spi 0, message ID = 0, sa = 0x6D12A00
*Sep 21 08:33:43.425: ISAKMP: (1011): SA authentication status: authenticated
```

```
*Sep 21 08:33:43.425: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::2
*Sep 21 08:33:43.425: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.425: ISAKMP: (1011): Process initial contact, bring down
existing phase 1 and 2 SA's with local 2001: DB8::3 remote 2001: DB8::2
remote port 500
*Sep 21 08:33:43.425: ISAKMP: Trying to insert a peer 2001: DB8::3/2001:
DB8::2/500/, and inserted successfully 8E45588.
*Sep 21 08:33:43.425: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.425: ISAKMP: (1011): Old State = IKE_R_MM5 New State =
IKE_R_MM5
```

メイン モード メッセージ 6 (MM6) : 応答側が ID を送信します。 フェーズ 1 が完了します。

次が含まれます。

- ピアから送信されたリモート ID
- 選択するトンネル グループに関する最終決定

```
*Sep 21 08:33:43.425: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.425: ISAKMP: (1011): SA is doing pre-shared key authentication
using id type ID_IPV6_ADDR
*Sep 21 08:33:43.425: ISAKMP (1011): ID payload
  next-payload : 8
  type          : 5
  address       : 2001: DB8::3
  protocol      : 17
  port          : 500
  length        : 24
*Sep 21 08:33:43.425: ISAKMP: (1011):Total payload length: 24
*Sep 21 08:33:43.425: ISAKMP: (1011): sending packet to 2001: DB8::2 my_port
500 peer_port 500 (R) MM_KEY_EXCH
*Sep 21 08:33:43.425: ISAKMP: (1011): Sending an IKE IPv6 Packet.
*Sep 21 08:33:43.425: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.425: ISAKMP: (1011): Old State = IKE_R_MM5 New State =
IKE_P1_COMPLETE
```

関連する設定 :

```
crypto isakmp identity ...
```

クイック モード メッセージ 1 (QM1)

```
*Sep 21 08:33:43.433: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: set new node 1371333358 to QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: (1011): processing HASH payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing SA payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):Checking IPSec proposal 1
*Sep 21 08:33:43.433: ISAKMP: transform 1, ESP_AES
*Sep 21 08:33:43.433: ISAKMP:   attributes in transform:
*Sep 21 08:33:43.433: ISAKMP:     encaps is 1 (Tunnel)
*Sep 21 08:33:43.433: ISAKMP:     SA life type in seconds
*Sep 21 08:33:43.433: ISAKMP:     SA life duration (basic) of 3600
*Sep 21 08:33:43.433: ISAKMP:     SA life type in kilobytes
*Sep 21 08:33:43.433: ISAKMP:     SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Sep 21 08:33:43.433: ISAKMP:     authenticator is HMAC-SHA
```

```

*Sep 21 08:33:43.433: ISAKMP:      key length is 128
*Sep 21 08:33:43.433: ISAKMP: (1011):atts are acceptable.
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 2001: DB8::3:0, remote= 2001: DB8::2:0,
  local_proxy= ::/0/256/0,
  remote_proxy= ::/0/256/0,
  protocol= ESP, transform= NONE (Tunnel),
  lifedur= 0s and 0kb,
  spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
*Sep 21 08:33:43.433: ISAKMP: (1011): processing NONCE payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):QM Responder gets spi
*Sep 21 08:33:43.433: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.433: ISAKMP: (1011): Old State = IKE_QM_READY New State =
IKE_QM_SPI_STARVE

```

関連コンフィギュレーション :

```

*Sep 21 08:33:43.433: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: set new node 1371333358 to QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: (1011): processing HASH payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing SA payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):Checking IPsec proposal 1
*Sep 21 08:33:43.433: ISAKMP: transform 1, ESP_AES
*Sep 21 08:33:43.433: ISAKMP:   attributes in transform:
*Sep 21 08:33:43.433: ISAKMP:     encaps is 1 (Tunnel)
*Sep 21 08:33:43.433: ISAKMP:     SA life type in seconds
*Sep 21 08:33:43.433: ISAKMP:     SA life duration (basic) of 3600
*Sep 21 08:33:43.433: ISAKMP:     SA life type in kilobytes
*Sep 21 08:33:43.433: ISAKMP:     SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Sep 21 08:33:43.433: ISAKMP:     authenticator is HMAC-SHA
*Sep 21 08:33:43.433: ISAKMP:     key length is 128
*Sep 21 08:33:43.433: ISAKMP: (1011):atts are acceptable.
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 2001: DB8::3:0, remote= 2001: DB8::2:0,
  local_proxy= ::/0/256/0,
  remote_proxy= ::/0/256/0,
  protocol= ESP, transform= NONE (Tunnel),
  lifedur= 0s and 0kb,
  spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
*Sep 21 08:33:43.433: ISAKMP: (1011): processing NONCE payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):QM Responder gets spi
*Sep 21 08:33:43.433: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.433: ISAKMP: (1011): Old State = IKE_QM_READY New State =
IKE_QM_SPI_STARVE

```

クイックモードメッセージ 2 (QM2)

次が含まれます。

- リモート エンドがパラメータを送信します。
- 提案された2つのフェーズ2 ライフタイムのうち短い方が選択されます。

```
*Sep 21 08:33:43.433: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: set new node 1371333358 to QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: (1011): processing HASH payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing SA payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):Checking IPsec proposal 1
*Sep 21 08:33:43.433: ISAKMP: transform 1, ESP_AES
*Sep 21 08:33:43.433: ISAKMP: attributes in transform:
*Sep 21 08:33:43.433: ISAKMP: encaps is 1 (Tunnel)
*Sep 21 08:33:43.433: ISAKMP: SA life type in seconds
*Sep 21 08:33:43.433: ISAKMP: SA life duration (basic) of 3600
*Sep 21 08:33:43.433: ISAKMP: SA life type in kilobytes
*Sep 21 08:33:43.433: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Sep 21 08:33:43.433: ISAKMP: authenticator is HMAC-SHA
*Sep 21 08:33:43.433: ISAKMP: key length is 128
*Sep 21 08:33:43.433: ISAKMP: (1011):atts are acceptable.
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 2001: DB8::3:0, remote= 2001: DB8::2:0,
local_proxy= ::/0/256/0,
remote_proxy= ::/0/256/0,
protocol= ESP, transform= NONE (Tunnel),
lifedur= 0s and 0kb,
spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
*Sep 21 08:33:43.433: ISAKMP: (1011): processing NONCE payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):QM Responder gets spi
*Sep 21 08:33:43.433: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.433: ISAKMP: (1011): Old State = IKE_QM_READY New State =
IKE_QM_SPI_STARVE
```

関連コンフィギュレーション :

```
*Sep 21 08:33:43.433: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: set new node 1371333358 to QM_IDLE
*Sep 21 08:33:43.433: ISAKMP: (1011): processing HASH payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing SA payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):Checking IPsec proposal 1
*Sep 21 08:33:43.433: ISAKMP: transform 1, ESP_AES
*Sep 21 08:33:43.433: ISAKMP: attributes in transform:
*Sep 21 08:33:43.433: ISAKMP: encaps is 1 (Tunnel)
*Sep 21 08:33:43.433: ISAKMP: SA life type in seconds
*Sep 21 08:33:43.433: ISAKMP: SA life duration (basic) of 3600
*Sep 21 08:33:43.433: ISAKMP: SA life type in kilobytes
*Sep 21 08:33:43.433: ISAKMP: SA life duration (VPI) of 0x0 0x46 0x50 0x0
*Sep 21 08:33:43.433: ISAKMP: authenticator is HMAC-SHA
*Sep 21 08:33:43.433: ISAKMP: key length is 128
*Sep 21 08:33:43.433: ISAKMP: (1011):atts are acceptable.
```



```
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1
*Sep 21 08:33:43.433: IPSEC(validate_proposal_request): proposal part #1,
(key eng. msg.) INBOUND local= 2001: DB8::3:0, remote= 2001: DB8::2:0,
  local_proxy= ::/0/256/0,
  remote_proxy= ::/0/256/0,
  protocol= ESP, transform= NONE (Tunnel),
  lifedur= 0s and 0kb,
  spi= 0x0(0), conn_id= 0, keysize= 128, flags= 0x0
*Sep 21 08:33:43.433: ISAKMP: (1011): processing NONCE payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011): processing ID payload. message ID =
1371333358
*Sep 21 08:33:43.433: ISAKMP: (1011):QM Responder gets spi
*Sep 21 08:33:43.433: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.433: ISAKMP: (1011): Old State = IKE_QM_READY New State =
IKE_QM_SPI_STARVE
```

クイックモードメッセージ3 (QM3) : フェーズ2が完了し、トンネルインターフェイスがアップします。

```
*Sep 21 08:33:43.437: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel23,
changed state to up
*Sep 21 08:33:43.437: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.437: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "QM done (await)"
*Sep 21 08:33:43.437: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.437: ISAKMP: (1011): Old State = IKE_QM_R_QM2 New State =
IKE_QM_PHASE2_COMPLETE
*Sep 21 08:33:43.437: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.437: IPSEC(key_engine_enable_outbound): rec'd enable notify
from ISAKMP
```

IOS ルータ : 発信側

メインモードメッセージ1 (MM1) : 初期のやり取り

次が含まれます。

- ベンダー ID (VID)
- 容量
- フェーズ1の提案
- IKE セキュリティ アソシエーション (SA)
- IPSec はすでに SA のテンプレートを作成します。

```
*Sep 21 08:33:43.437: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel23,
changed state to up
*Sep 21 08:33:43.437: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.437: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "QM done (await)"
*Sep 21 08:33:43.437: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
```

```
*Sep 21 08:33:43.437: ISAKMP: (1011): Old State = IKE_QM_R_QM2 New State =
IKE_QM_PHASE2_COMPLETE
*Sep 21 08:33:43.437: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.437: IPSEC(key_engine_enable_outbound): rec'd enable notify
from ISAKMP
```

関連コンフィギュレーション :

```
*Sep 21 08:33:43.437: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel23,
changed state to up
*Sep 21 08:33:43.437: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.437: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "QM done (await)"
*Sep 21 08:33:43.437: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.437: ISAKMP: (1011): Old State = IKE_QM_R_QM2 New State =
IKE_QM_PHASE2_COMPLETE
*Sep 21 08:33:43.437: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.437: IPSEC(key_engine_enable_outbound): rec'd enable notify
from ISAKMP
```

メイン モード メッセージ 2 (MM2) : 初期のやり取りへの応答

次が含まれます。

- ピアが、使用する Internet Security Association and Key Management Protocol (ISAKMP) ポリシーを選択します。
- IKE SA

```
*Sep 21 08:33:43.437: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel23,
changed state to up
*Sep 21 08:33:43.437: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.437: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "QM done (await)"
*Sep 21 08:33:43.437: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.437: ISAKMP: (1011): Old State = IKE_QM_R_QM2 New State =
IKE_QM_PHASE2_COMPLETE
*Sep 21 08:33:43.437: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.437: IPSEC(key_engine_enable_outbound): rec'd enable notify
from ISAKMP
```

メイン モード メッセージ 3 (MM3) : NAT 検出および Diffie-Hellman 交換

次が含まれます。

- NAT 検出ペイロードおよびハッシュ
- DH 交換の開始
- Dead Peer Detection (DPD) のサポート

```
*Sep 21 08:33:43.437: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel23,
changed state to up
*Sep 21 08:33:43.437: ISAKMP (1011): received packet from 2001: DB8::2 dport
500 sport 500 Global (R) QM_IDLE
*Sep 21 08:33:43.437: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "QM done (await)"
*Sep 21 08:33:43.437: ISAKMP: (1011):Node 1371333358, Input =
```

IKE_MSG_FROM_PEER, IKE_QM_EXCH

***Sep 21 08:33:43.437: ISAKMP: (1011): Old State = IKE_QM_R_QM2 New State = IKE_QM_PHASE2_COMPLETE**

*Sep 21 08:33:43.437: IPSEC(key_engine): got a queue event with 1 KMI message(s)

*Sep 21 08:33:43.437: IPSEC(key_engine_enable_outbound): rec'd enable notify from ISAKMP

メイン モード メッセージ 4 (MM4) : NAT 検出および Diffie-Hellman 交換

次が含まれます。

- NAT 検出ペイロード
- DH 交換の開始
- 追加の VID (DPD、Unity サポート)
- 別の IOS デバイスとの通信に関する知識

*Sep 21 08:33:43.273: ISAKMP (0): received packet from 2001: DB8::3 dport 500 sport 500 Global (I) MM_SA_SETUP

*Sep 21 08:33:43.273: ISAKMP: (0):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH

*Sep 21 08:33:43.273: ISAKMP: (0): Old State = IKE_I_MM3 New State = IKE_I_MM4

***Sep 21 08:33:43.273: ISAKMP: (0): processing KE payload. message ID = 0**

***Sep 21 08:33:43.281: ISAKMP: (0): processing NONCE payload. message ID = 0**

*Sep 21 08:33:43.281: ISAKMP: (0):found peer pre-shared key matching 2001: DB8::3

*Sep 21 08:33:43.281: ISAKMP: (1011): processing vendor id payload

***Sep 21 08:33:43.281: ISAKMP: (1011): vendor ID is Unity**

*Sep 21 08:33:43.281: ISAKMP: (1011): processing vendor id payload

***Sep 21 08:33:43.281: ISAKMP: (1011): vendor ID is DPD**

*Sep 21 08:33:43.281: ISAKMP: (1011): processing vendor id payload

***Sep 21 08:33:43.281: ISAKMP: (1011): speaking to another IOS box!**

*Sep 21 08:33:43.281: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_MAIN_MODE

*Sep 21 08:33:43.281: ISAKMP: (1011): Old State = IKE_I_MM4 New State =
IKE_I_MM4

メイン モード メッセージ 5 (MM5) : ID の送信

次が含まれます。

- リモートピア ID (ID)

*Sep 21 08:33:43.293: ISAKMP: (1011): Send initial contact

*Sep 21 08:33:43.293: ISAKMP: (1011): SA is doing pre-shared key authentication using id type **ID_IPV6_ADDR**

*Sep 21 08:33:43.293: ISAKMP (1011): ID payload

next-payload : 8

type : 5

address : 2001: DB8::2

protocol : 17

port : 500

length : 24

*Sep 21 08:33:43.293: ISAKMP: (1011):Total payload length: 24

*Sep 21 08:33:43.293: ISAKMP: (1011): sending packet to 2001: DB8::3 my_port 500 peer_port 500 (I) MM_KEY_EXCH

*Sep 21 08:33:43.293: ISAKMP: (1011): Sending an IKE IPv6 Packet.

*Sep 21 08:33:43.293: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE

*Sep 21 08:33:43.293: ISAKMP: (1011): Old State = IKE_I_MM4 New State =

IKE_I_MM5

関連コンフィギュレーション :

```
*Sep 21 08:33:43.293: ISAKMP: (1011): Send initial contact
*Sep 21 08:33:43.293: ISAKMP: (1011): SA is doing pre-shared key authentication
using id type ID_IPV6_ADDR
*Sep 21 08:33:43.293: ISAKMP (1011): ID payload
    next-payload : 8
    type         : 5
    address      : 2001: DB8::2
    protocol     : 17
    port         : 500
    length       : 24
*Sep 21 08:33:43.293: ISAKMP: (1011):Total payload length: 24
*Sep 21 08:33:43.293: ISAKMP: (1011): sending packet to 2001: DB8::3 my_port
500 peer_port 500 (I) MM_KEY_EXCH
*Sep 21 08:33:43.293: ISAKMP: (1011): Sending an IKE IPv6 Packet.
*Sep 21 08:33:43.293: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.293: ISAKMP: (1011): Old State = IKE_I_MM4  New State =
IKE_I_MM5
```

メインモードメッセージ6 (MM6) : リモートピアID、フェーズ1が確立されます。

次が含まれます。

- キー再生成時刻が開始します。
- リモートID (この場合はアドレス)
- プロファイルで受信する決定

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport
500 sport 500 Global (I) MM_KEY_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
    next-payload : 8
    type         : 5
    address      : 2001: DB8::3
    protocol     : 17
    port         : 500
    length       : 24
*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::3
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
DB8::3/500/, and inserted successfully 9344BE8.
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5  New State =
IKE_I_MM6
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6  New State =
IKE_I_MM6
*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6  New State =
IKE_P1_COMPLETE
```

関連コンフィギュレーション :

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport
500 sport 500 Global (I) MM_KEY_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
    next-payload : 8
    type          : 5
    address       : 2001: DB8::3
    protocol      : 17
    port          : 500
    length        : 24
*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::3
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
DB8::3/500/, and inserted successfully 9344BE8.
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5 New State =
IKE_I_MM6

*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_I_MM6

*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MESG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_P1_COMPLETE
```

クイックモードメッセージ 1 (QM1) : ピアがフェーズ 2 を開始します。

次が含まれます。

- リモートおよびローカル プロキシ ID
- トランスフォーム セット

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport
500 sport 500 Global (I) MM_KEY_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
    next-payload : 8
    type          : 5
    address       : 2001: DB8::3
    protocol      : 17
    port          : 500
    length        : 24
*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::3
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
DB8::3/500/, and inserted successfully 9344BE8.
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MESG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5 New State =
IKE_I_MM6
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,  
IKE_PROCESS_MAIN_MODE  
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6 New State =  
IKE_I_MM6
```

```
*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,  
IKE_PROCESS_COMPLETE
```

```
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6 New State =  
IKE_P1_COMPLETE
```

関連コンフィギュレーション :

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport  
500 sport 500 Global (I) MM_KEY_EXCH
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
```

```
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
```

```
next-payload : 8
```

```
type : 5
```

```
address : 2001: DB8::3
```

```
protocol : 17
```

```
port : 500
```

```
length : 24
```

```
*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
```

```
DB8::3
```

```
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
```

```
DB8::3/500/, and inserted successfully 9344BE8.
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5 New State =
```

```
IKE_I_MM6
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
```

```
IKE_PROCESS_MAIN_MODE
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
```

```
IKE_I_MM6
```

```
*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
```

```
IKE_PROCESS_COMPLETE
```

```
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
```

```
IKE_P1_COMPLETE
```

クイックモードメッセージ 2 (QM2)

次が含まれます。

- プロキシ ID の確認
- トンネル タイプ
- Perfect Forwarding Secrecy (PFS) 設定

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport  
500 sport 500 Global (I) MM_KEY_EXCH
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
```

```
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
```

```
next-payload : 8
```

```
type : 5
```

```
address : 2001: DB8::3
```

```
protocol : 17
```

```
port : 500
```

```
length : 24
```

```
*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
```

```
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::3
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
DB8::3/500/, and inserted successfully 9344BE8.
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5 New State =
IKE_I_MM6

*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_I_MM6

*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_P1_COMPLETE
```

関連コンフィギュレーション :

```
*Sep 21 08:33:43.297: ISAKMP (1011): received packet from 2001: DB8::3 dport
500 sport 500 Global (I) MM_KEY_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): processing ID payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP (1011): ID payload
    next-payload : 8
    type          : 5
    address       : 2001: DB8::3
    protocol      : 17
    port          : 500
    length        : 24

*Sep 21 08:33:43.297: ISAKMP: (0):: peer matches *none* of the profiles
*Sep 21 08:33:43.297: ISAKMP: (1011): processing HASH payload. message ID = 0
*Sep 21 08:33:43.297: ISAKMP: (1011): SA authentication status: authenticated
*Sep 21 08:33:43.297: ISAKMP: (1011): SA has been authenticated with 2001:
DB8::3
*Sep 21 08:33:43.297: ISAKMP: Trying to insert a peer 2001: DB8::2/2001:
DB8::3/500/, and inserted successfully 9344BE8.
*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_FROM_PEER, IKE_MM_EXCH
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM5 New State =
IKE_I_MM6

*Sep 21 08:33:43.297: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_MAIN_MODE
*Sep 21 08:33:43.297: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_I_MM6

*Sep 21 08:33:43.301: ISAKMP: (1011):Input = IKE_MSG_INTERNAL,
IKE_PROCESS_COMPLETE
*Sep 21 08:33:43.301: ISAKMP: (1011): Old State = IKE_I_MM6 New State =
IKE_P1_COMPLETE
```

クイックモードメッセージ3 (QM3) : フェーズ2の確立

次が含まれます。

- **トラフィックを渡すセキュリティポリシー インデックス (SPI) の設定**

```
*Sep 21 08:33:43.305: ISAKMP: (1011): Sending an IKE IPv6 Packet.
*Sep 21 08:33:43.305: ISAKMP: (1011): deleting node 1371333358 error FALSE
reason "No Error"
```

```

*Sep 21 08:33:43.305: ISAKMP: (1011):Node 1371333358, Input =
IKE_MSG_FROM_PEER, IKE_QM_EXCH
*Sep 21 08:33:43.305: ISAKMP: (1011): Old State = IKE_QM_I_QM1 New State =
IKE_QM_PHASE2_COMPLETE
*Sep 21 08:33:43.305: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Sep 21 08:33:43.305: IPSEC(crypto_ipsec_create_ipsec_sas): Map found
Tunnel23-head-0
*Sep 21 08:33:43.305: IPSEC(crypto_ipsec_sa_find_ident_head): reconnecting
with the same proxies and peer 2001: DB8::3
*Sep 21 08:33:43.305: IPSEC(create_sa): sa created,
(sa) sa_dest= 2001: DB8::2, sa_proto= 50,
sa_spi= 0x45F16A9A(1173449370),
sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 305
sa_lifetime(k/sec)= (4608000/3439)
*Sep 21 08:33:43.305: IPSEC(create_sa): sa created,
(sa) sa_dest= 2001: DB8::3, sa_proto= 50,
sa_spi= 0x221A7153(572158291),
sa_trans= esp-aes esp-sha-hmac , sa_conn_id= 306
sa_lifetime(k/sec)= (4608000/3439)
R2(config-if)#
*Sep 21 08:33:43.309: %LINEPROTO-5-UPDOWN: Line protocol on Interface
Tunnel23, changed state to up

```

トンネルの確認

```

sh crypto ipsec sa

interface: Tunnel23
  Crypto map tag: Tunnel23-head-0, local addr 2001: DB8::2

protected vrf: (none)
local ident (addr/mask/prot/port): (::/0/0/0)
remote ident (addr/mask/prot/port): (::/0/0/0)
current_peer 2001: DB8::3 port 500
  PERMIT, flags={origin_is_acl,}
    #pkts encaps: 4, #pkts encrypt: 4, #pkts digest: 4
    #pkts decaps: 4, #pkts decrypt: 4, #pkts verify: 4
    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 0, #recv errors 0

local crypto endpt.: 2001: DB8::2,
remote crypto endpt.: 2001: DB8::3
path mtu 1500, ipv6 mtu 1500, ipv6 mtu idb Ethernet0/0
current outbound spi: 0x221A7153(572158291)
PFS (Y/N): N, DH group: none

inbound esp sas:
  spi: 0x45F16A9A(1173449370)
    transform: esp-aes esp-sha-hmac ,
    in use settings ={Tunnel, }
    conn id: 305, flow_id: SW:305, sibling_flags 80000041, crypto map:
Tunnel23-head-0
    sa timing: remaining key lifetime (k/sec): (4183789/3408)
    IV size: 16 bytes
    replay detection support: Y
    Status: ACTIVE

inbound ah sas:

inbound pcp sas:

```



```
outbound esp sas:
  spi: 0x221A7153(572158291)
  transform: esp-aes esp-sha-hmac ,
  in use settings ={Tunnel, }
  conn id: 306, flow_id: SW:306, sibling_flags 80000041, crypto map:
Tunnel23-head-0
  sa timing: remaining key lifetime (k/sec): (4183790/3408)
  IV size: 16 bytes
  replay detection support: Y
  Status: ACTIVE
```

```
R2(config-if)#do ping fe80::23:3
Output Interface: tunnel23
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FE80::23:3, timeout is 2 seconds:
Packet sent with a source address of FE80::23:2%Tunnel23
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/11/20 ms
R2(config-if)#do sh crypto ipsec sa | i caps|ident
  local ident (addr/mask/prot/port): (::/0/0/0)
  remote ident (addr/mask/prot/port): (::/0/0/0)
    #pkts encaps: 9, #pkts encrypt: 9, #pkts digest: 9
    #pkts decaps: 9, #pkts decrypt: 9, #pkts verify: 9
```

トンネルはアップしており、トラフィックを渡しています。

関連情報

- [IPSec に関する Wikipedia の記事](#) : 標準および参考文献には多くの有用な情報が含まれています。
- [ASA IPsec および IKE デバッグ \(IKEv1 アグレッシブ モード\) のトラブルシューティングに関するテクニカル ノート](#)
- [ASA IPsec および IKE のデバッグ \(IKEv1 メイン モード\) のトラブルシューティング テクニカルノート](#)
- [テクニカルサポートとドキュメント - Cisco Systems](#)